IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Patent Application No. 10/635,402

Confirmation No. 1210

Appellant: Ahn

Filed: August 6, 2003

TC/AU: 1617

Examiner: Soroush, Ali

Docket No.: 220318 (Client Reference No. 100.001US1)

Customer No.: 23460

APPELLANT'S APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In support of the appeal from the final rejection dated August 10, 2010, Appellant now submits his Brief.

Real Party In Interest

The patent application that is the subject of this appeal is assigned to Angstrom Medica.

Related Appeals and Interferences

There are no appeals or interferences that are related to this appeal.

Status of Claims

The status of the claims is set forth in the *Claims Appendix* attached hereto. Claims 1-17, 69, 70 and 78-85 are currently pending and are the subject of this appeal.

Status of Amendments

No amendment was filed subsequent to final rejection. All previous amendments to the claims have been entered by the Office.

Summary of Claimed Subject Matter

Claims 1-17, 69, 70 and 78-82 are directed to a composition comprising particulate tricalcium phosphate (TCP) having an average particle size of about 5 μm or less, an average crystal size of about 250 nm or less and a surface area of about 20 m^2/g or greater, wherein when the particulate TCP that is densified to form an article having a minimum dimension of about 0.5 cm or greater the article transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. *See, e.g.,* p. 4, ll. 34-37; p. 13, ll. 14-15; p. 14, ll. 11-13. Claims 83-85 are further directed to a composition comprising particulate TCP that is produced using a wet chemical approach, and wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article has a density that is 90% of the theoretical density or greater. *See, e.g.,* p. 6, ll. 6-8; p. 13, ll. 14-15; p. 13, ll. 36-37.

Grounds of Rejection to be Reviewed on Appeal

1. Whether claims 1-3, 5, 70 and 78 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

2. Whether claim 4 is unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

3. Whether claims 6 and 7 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

4. Whether claims 8-11 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073), further in view of Kijima et al. (U.S. Patent No. 5,185,177).

5. Whether claim 12 is unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

6. Whether claims 13 and 14 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

7. Whether claims 15 and 16 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073), further in view of Dalal et al. (U.S. Patent No. 6,949,251).

8. Whether claim 17 is unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

9. Whether claim 69 is unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

10. Whether claim 79 is unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

11. Whether claims 80-82 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

12. Whether claims 83-85 are unpatentable under 35 U.S.C. § 103(a), over Kawamura et al. (U.S. Patent No. 4,747,556), in view of Tanaka et al. (U.S. Patent No. 6,441,073).

Argument

A. Claims 1-3, 5, 17, 70, and 78

Appellant respectfully submits that appealed claims 1-7, 12-14, 17, 69-70, and 78-85 are inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein.

Each of appealed claims 1-3, 5, 17, 70, and 78 recites a composition comprising particulate TCP having the following five properties:

(1) an average particle size of about 5 μm or less;
(2) an average crystal size of about 250 nm or less;
(3) a surface area of about 20 m^2/g or greater;
(4) a minimum dimension of about 0.5 cm or greater when the particulate TCP is densified to form an article; and
(5) transmittance of about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm when the particulate TCP is densified to form the aforementioned article.

Each of appealed claims 1-3, 5, 17, 70, and 78 is inventive over Kawamura et al. and Tanaka et al. Neither Kawamura et al. nor Tanaka et al., taken individually, discloses the (1) particle size, (2) crystal size, and (3) surface area recited by the appealed claims, and one of ordinary skill in the art would not have been motivated to combine the surface area and crystal size of Kawamura et al. with the particle size of Tanaka et al. to arrive at the invention recited in the appealed claims. Additionally, neither Kawamura et al. nor Tanaka et al., taken alone or in combination, discloses (4) densification of the TCP to form an article having a minimum dimension of about 0.5 cm or greater, or (5) transmittance of about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm when the particulate TCP is densified to form the aforementioned article.

1. Properties (1), (2), and (3)

Neither Kawamura et al. nor Tanaka et al., taken individually, discloses (1) an average particle size of 5 μm or less, (2) an average crystal size of about 250 nm or less, and (3) a surface area of about 20 m^2/g or greater, as recited in the appealed claims. Instead, Kawamura et al. discloses only a surface area of 30 m^2/g and a crystal size of 100 nm while making no mention of particle size, and Tanaka et al. discloses only a particle size range of 0.1-200 μm while making no mention of either surface area or crystal size.

The Examiner contends that it would have been obvious for a person of ordinary skill in the art to combine the surface area (30 m^2/g) and crystal size (0.1 μm, or 100 nm) taught in Kawamura et al. with the particle size (0.1-200 μm) taught in Tanaka et al. to arrive at the invention recited in the appealed claims. Specifically, the Examiner contends that Tanaka et al. teaches that particle size is important to ensure that the TCP does not dissolve either too fast or too slow so as to inhibit tissue reconstruction, and thus, a person of ordinary skill in the art would have been motivated to combine the particle size of Tanaka et al. with the teachings of Kawamura et al. to arrive at the invention recited in the appealed claims.

However, and as set forth more fully herein, Appellant respectfully asserts that one of ordinary skill in the art would not have been motivated to combine the surface area and crystal size of Kawamura et al. with the particle size of Tanaka et al. to arrive at the invention recited in the appealed claims because the TCP taught in Kawamura et al. was known to be potentially biologically unsafe, and because Kawamura et al. and Tanaka et al. are directed to completely different types of biomaterials that address the problems of article strength in different ways.

The invention recited in the appealed claims is directed towards a composition comprising particulate TCP, a bioceramic material for use in implants. *See, e.g.,* ¶ [0002]. A person of ordinary skill in the art who sought to make a bioceramic material for use in implants, as in the case of the invention recited in the appealed claims, would not have been motivated to combine Kawamura et al. with Tanaka et al. due to the understanding that the TCP disclosed in Kawamura et al. may be biologically unsafe. While Kawamura et al. also purports to be directed to a TCP powder suitable for use as a raw material for implants, Kawamura et al. was later recognized by its own inventors as being potentially biologically unsafe due to impurities such as non-reacted matter like $Ca(OH)_2$. *See* Hakamatsuka et al. (*i.e.*, U.S. Patent No. 5,322,675) at col. 2, ll. 9-11. The invention disclosed in Hakamatsuka et al. was invented by, *inter alia*, Sukezo Kawamura and Motohiro Toriyama, the two named inventors of Kawamura et al. These two named inventors recognized a problem with the invention set forth in Kawamura et al.—namely, that the invention may cause hemolysis, antigenicity, and cytotoxicity. All of this teaches against using the material disclosed in Kawamura et al. in a biological implant. *See, e.g.,* Hakamatsuka et al. at col. 2, ll. 22-27. Therefore, a person of ordinary skill in the art would have recognized the potential biological safety concerns associated with Kawamura et al. and would have avoided use of the teachings of Kawamura et al., either alone or in combination with any other reference including Tanaka et al., to arrive at the invention recited in the appealed claims.

Additionally, a person of ordinary skill in the art would not have been motivated to modify the β-tricalcium phosphate powder of Kawamura et al. to produce particulate TCP having the particle size taught by Tanaka et al. because Kawamura et al. and Tanaka et al. are directed to completely different types of biomaterials that address the problems of article strength in different ways. Kawamura et al. is directed to a method for producing β-

tricalcium phosphate powder, wherein the β-tricalcium phosphate powder is used *alone* as a raw material to produce sintered articles having high strength that can be used as bioceramics such as artificial bones. *See, e.g.*, col. 1, ll. 7-16; col. 4, ll. 34-38. Contrastingly, Tanaka et al. is directed to a biomaterial comprising particulate calcium phosphate (*e.g.*, tricalcium phosphate) compounded with a copolymer, wherein the copolymer imparts mechanical strength to the calcium phosphate powder so as to produce a rigid biomaterial. *See, e.g.*, col. 1, ll. 5-7; col. 5, ll. 15-28 and 35-47.

One of ordinary skill in the art would appreciate that modifying the properties of the β-tricalcium phosphate powder of Kawamura et al. so as to achieve the particle size taught by Tanaka et al. could compromise the strength of any resulting sintered article such that it would no longer be useful as a bioceramic. Moreover, one of ordinary skill in the art would appreciate that there is no need to modify the physical properties of the tricalcium phosphate powder used by Tanaka et al. because Tanaka et al. teaches that only the particle size of the calcium phosphate material is important for the particular bioceramic application described therein. Accordingly, Appellant respectfully asserts that a one of ordinary skill in the art would not have been motivated to combine the surface area and crystal size of Kawamura et al. with the particle size of Tanaka et al. to arrive at the invention recited in the appealed claims.

2. Properties (4) and (5)

Even if a person of ordinary skill in the art were motivated to combine the surface area and crystal size of Kawamura et al. with the particle size of Tanaka et al., one would not arrive at the invention recited in the appealed claims. The appealed claims further recite that the claimed composition comprising particulate TCP also has (4) a minimum dimension of about 0.5 cm or greater when the particulate TCP is densified to form an article, and (5) transmittance of about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm when the particulate TCP is densified to form the aforementioned article. Neither Kawamura et al. nor Tanaka et al., taken alone or in combination, discloses (4) densification of the TCP to form an article having a minimum dimension of about 0.5 cm or greater, or (5) transmittance of about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Indeed, nothing in Kawamura et al. suggests that TCP can be sintered to form an article with a minimum dimension of 0.5 cm or that the sintered TCP

taught in Kawamura et al. transmits light to any degree. Similarly, there is no mention whatsoever of the ability of the calcium phosphate powder taught in Tanaka et al. to transmit light. Moreover, because Tanaka et al. teaches a biomaterial comprising TCP compounded with a copolymer, one of ordinary skill in the art would expect the presence of the copolymer to adversely affect the ability of the biomaterial to transmit light.

The Examiner contends that the claimed light transmittance property is inherent to a TCP article having properties (1)-(3) produced according to the teachings of Kawamura et al. and Tanaka et al. In order to establish the inherency of a claimed property in the prior art, the prior art must *necessarily* have that claimed property. *See, e.g., Mehl/Biophile Int'l Corp. v. Milgraum*, 192 F.3d 1362 (Fed. Cir. 1999) ("Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient."). However, and as set forth more fully herein, Appellant respectfully asserts that one of ordinary skill in the art would not necessarily obtain a TCP article having (4) a minimum dimension of about 0.5 cm or greater when the particulate TCP is densified to form an article, and (5) transmittance of about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm when the particulate TCP is densified to form the aforementioned article when combining the surface area and crystal size of Kawamura et al. with the particle size of Tanaka et al.

By way of background, the invention recited in the appealed claims is based, in part, upon the discovery that minimizing crystal size and particle size while maximizing surface area makes consolidation of the crystals easier because smaller crystals can re-arrange and pack more readily, and in turn, this agglomeration of crystals prior to densification serves to enhance densification. *See, e.g.,* ¶ [0022]. More specifically, Appellants discovered that improved densification occurs when the average particle size of the TCP approaches the average crystal size of the TCP. *See id.* This improved densification allows the formation of densified TCP articles having a minimum dimension of about 0.5 cm or greater that transmit about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Thus, the invention recited in the appealed claims is based, at least in part, upon the discovery that the size of *both* the particles and crystals affect densification, and hence, the ability of an article formed from the densified TCP to transmit about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm.

Thus, while Kawamura et al. discloses a particular crystal size and surface area of TCP, and while Tanaka et al. discloses a particular particle size of TCP, neither reference teaches or suggests that these properties affect the ability of an article formed from densified TCP to transmit light. As such, one of ordinary skill in the art, in view of the teachings of both Kawamura et al. and Tanaka et al., would not have expected that reducing particle size in accordance with Tanaka et al., while maintaining the crystal size and surface area taught in Kawamura et al., would improve densification such that the resulting TCP powder could be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm.

Additionally, and as set forth in the Declaration Under 37 C.F.R. 1.132 of Edward S. Ahn, Ph.D. (hereinafter, "Declaration of Ahn"), submitted with the response to Office Action dated October 26, 2009, a tricalcium phosphate material characterized by the structural features (1)-(3) recited in the pending claims (*i.e.*, an average crystal size of 250 nm or less, an average particle size of 5 μm or less, and a surface area or about 20 m^2/g or greater) will not necessarily form an article having a minimum dimension of 0.5 cm that further transmits 50% or more of light having a wavelength in the range of about 150 nm to about 1,000 nm. *See* Declaration of Ahn at ¶ 3. Particulate tricalcium phosphate powders that form such articles having light transmittance properties must have the recited structural features in the proper ratio, and must further be free of chemical impurities (*e.g.*, calcium phosphate impurities) and/or phase impurities (*e.g.*, undesirable ratios of α-TCP and β-TCP) that adversely affect the microstructure of the ceramic and cause significant flaw sizes that prevent particulate TCP from being able to be densified to form an article that is permeable to light. *See id.* at ¶¶ 4-5. It is simply not the case that a reference disclosing features (1)-(3) of the pending claims inherently also discloses features (4) and (5).

Also, there is no evidence presented in either Kawamura et al. or Tanaka et al. which indicates that, if their teachings were to be combined, an article having a minimum dimension of 0.5 cm that further transmits 50% or more of light having a wavelength in the range of about 150 nm to about 1,000 nm would necessarily result. Indeed, the Examiner has relied on a conclusory assertion that such a result would be obtained, without providing any basis for such an assertion. Such conclusory assertions are insufficient to support a *prima facie*

case of obviousness. *See, e.g., In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). Furthermore, as set forth in the Declaration of Ahn, and as previously stated, a tricalcium phosphate material characterized by the structural features (1)-(3) recited in the appealed claims (*i.e.*, an average crystal size of 250 nm or less, an average particle size of 5 μm or less, and a surface area or about 20 m^2/g or greater) will not necessarily form an article having a minimum dimension of 0.5 cm that further transmits 50% or more of light having a wavelength in the range of about 150 nm to about 1,000 nm. *See* Declaration of Ahn at ¶ 3.

Moreover, one of ordinary skill in the art would not arrive at a composition of the purity recited in the appealed claims, such that when the claimed particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm, by using the process set forth in Kawamura et al. Kawamura et al. uses an attrition milling process to obtain the calcium phosphate composition set forth therein. It is well-known in the art that attrition milling leads to impurities in the resulting milled composition. *See, e.g.,* F.F. Lange et al., "Effects of attrition milling and post-sintering heat treatment on fabrication, microstructure and properties of transformation toughened ZrO_2," *Journal of Materials Science*, 21:768-774 (1986) ("[I]mpurities introduced during attrition milling can be significant relative to the unmilled powder."), submitted with the response to Office Action dated October 12, 2010; *see also* Declaration of Ahn at ¶ 6. Indeed, and as discussed previously, the invention set forth in Kawamura et al. was later recognized by its own inventors as containing impurities such as non-reacted matter like $Ca(OH)_2$. *See* Hakamatsuka et al. at col. 2, ll. 9-11. This and other impurities would undoubtedly negatively impact the ability of the densified TCP to transmit light. *See* Declaration of Ahn at ¶ 5. Thus, one would not arrive at the invention recited in the appealed claims, with the claimed purity, by following the teachings of Kawamura et al. in combination with Tanaka et al.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claims 1-3, 5, 17, 70, and 78 obvious.

B. Claim 4

Appellant respectfully submits that appealed claim 4 is inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein. Appealed claim 4 depends from claim 1 and accordingly recites a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claim 4 is non-obvious over Kawamura et al. and Tanaka et al.

Moreover, appealed claim 4 additionally recites that the particulate TCP comprises α-TCP. Neither Kawamura et al. nor Tanaka et al. specify that the particulate TCP comprises α-TCP. In direct contrast to appealed claim 4, Kawamura et al. discloses only β-TCP. Thus, one of ordinary skill in the art could not arrive at the invention recited in appealed claim 4 by merely combining the teachings of Kawamura et al. and Tanaka et al. Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claim 4 obvious.

C. Claims 6 and 7

Appellant respectfully submits that appealed claims 6 and 7 are inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein. Appealed claims 6 and 7 each depend, either directly or indirectly, from claim 1 and accordingly recite a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claims 6 and 7 are non-obvious over Kawamura et al. and Tanaka et al.

Moreover, appealed claim 6 recites that the composition further comprises a secondary additive, and appealed claim 7 recites that the secondary additive is present in an amount of between about 1% and about 50% by volume. The Examiner asserts that Tanaka et al. teaches the addition of both a polymer additive as well as a pharmaceutical additive. However, Appellant respectfully submits that the teachings of Kawamura et al. and Tanaka et al. fail to render appealed claims 6 and 7 obvious.

Tanaka et al. is directed to a biomaterial comprising particulate calcium phosphate, such as a tricalcium phosphate, which is compounded with a copolymer of lactic acid,

glycolic acid, and caprolactone. However, nothing in Tanaka et al. teaches or suggests adding a secondary additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims. Additionally, nothing in Tanaka et al. teaches or suggests adding a secondary additive to a composition comprising particulate TCP while maintaining the ability to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm, as required by the appealed claims. Indeed, a person of ordinary skill in the art would expect the opposite—namely, that adding a secondary additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims would alter the ability of the TCP to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Thus, one of ordinary skill in the art would not have been motivated to add a secondary additive to the claimed composition in view of the teachings of Tanaka et al.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claims 6 and 7 obvious.

D. Claims 8-11

Appellant respectfully submits that appealed claims 8-11 are inventive over Kawamura et al., Tanaka et al., and Kijima et al. Appealed claims 8-11 recite a composition comprising particulate TCP, further comprising a secondary additive that comprises a structural additive. The Examiner acknowledges that Kawamura et al. and Tanaka et al. fail to teach a secondary additive that is a structural additive, yet asserts that Kijima et al. teaches a ceramic implant comprising TCP and zirconia. However, Appellant respectfully submits that the teachings of Kijima et al. fail to cure the deficiencies of Kawamura et al. and Tanaka et al.

Appealed claims 8-11 each depend indirectly from claim 1 and accordingly recite a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, regardless of whether Kijima et al. teaches a secondary

additive that is a structural additive, as the Examiner argues, one of ordinary skill in the art would not arrive at the invention recited in appealed claims 8-11 by merely combining the teachings of Kawamura et al., Tanaka et al., and Kijima et al.

Moreover, even if the combination of Kawamura et al. and Tanaka et al. taught the five aforementioned properties, which they do not, a person of ordinary skill in the art still would not arrive at the invention of appealed claims 8-11 by merely combining the teachings of Kawamura et al. and Tanaka et al. with Kijima et al. Kijima et al. is directed to a sintered body of zirconia having a porous, sintered coating comprising a mixture of zirconia and tricalcium phosphate. Specifically, Kijima et al. teaches that, most preferably, zirconia powder and hydroxyapatite are coated on the surface of a non-sintered body of zirconia, followed by sintering, which converts the hydroxyapatite to α-TCP, and the body of zirconia becomes sintered. Nothing in Kijima et al. teaches or suggests adding a structural additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims. Additionally, nothing in Kijima et al. teaches or suggests adding a structural additive to a composition comprising particulate TCP while maintaining the ability to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Indeed, a person of ordinary skill in the art would expect the opposite—namely, that adding a structural additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims would alter the ability of the TCP to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al., Tanaka et al., and Kijima et al. fails to render appealed claims 8-11 obvious.

E. Claim 12

Appellant respectfully submits that appealed claim 12 is inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein. Appealed claim 12 depends indirectly from claim 1 and accordingly recites a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either

taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claim 12 is non-obvious over Kawamura et al. and Tanaka et al.

Appealed claim 12 further recites a composition comprising particulate TCP, further comprising a secondary additive wherein the secondary additive is an organic species. The Examiner asserts that Tanaka et al. teaches the addition of both a polymer additive as well as a pharmaceutical additive. However, Appellant respectfully submits that the teachings of Kawamura et al. and Tanaka et al. fail to render appealed claim 12 obvious.

Tanaka et al. is directed to a biomaterial comprising particulate calcium phosphate, such as a tricalcium phosphate, which is compounded with a copolymer of lactic acid, glycolic acid, and caprolactone. However, nothing in Tanaka et al. teaches or suggests adding an organic species to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims. Additionally, nothing in Tanaka et al. teaches or suggests adding an organic species to a composition comprising particulate TCP while maintaining the ability to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Indeed, a person of ordinary skill in the art would expect the opposite—namely, that adding an organic species to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims would alter the ability of the TCP to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Thus, one of ordinary skill in the art would not have been motivated to add an organic species to the claimed composition in view of the teachings of Tanaka et al.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claim 12 obvious.

F. Claims 13 and 14

Appellant respectfully submits that appealed claims 13 and 14 are inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein. Appealed claims 13 and 14 each depend indirectly from claim 1 and accordingly recite a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et

al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claims 13 and 14 are non-obvious over Kawamura et al. and Tanaka et al.

Appealed claim 13 further recites a composition comprising particulate TCP, further comprising a secondary additive wherein the secondary additive is a polymeric additive. Appealed claim 14 specifies that the polymeric additive is selected from a specified list of polymeric additives. The Examiner asserts that Tanaka et al. teaches the addition of a polymer additive. However, Appellant respectfully submits that the teachings of Kawamura et al. and Tanaka et al. fail to render appealed claims 13 and 14 obvious.

Tanaka et al. is directed to a biomaterial comprising particulate calcium phosphate, such as a tricalcium phosphate, which is compounded with a copolymer of lactic acid, glycolic acid, and caprolactone. However, nothing in Tanaka et al. teaches or suggests adding a polymeric additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the pending claims. Additionally, nothing in Tanaka et al. teaches or suggests adding a polymeric additive to a composition comprising particulate TCP while maintaining the ability to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Indeed, a person of ordinary skill in the art would expect the opposite—namely, that adding a polymeric additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims would alter the ability of the TCP to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Thus, one of ordinary skill in the art would not have been motivated to add a polymeric additive to the claimed composition in view of the teachings of Tanaka et al.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claims 13 and 14 obvious.

G. Claims 15 and 16

Appellant respectfully submits that appealed claims 15 and 16 are inventive over Kawamura et al., Tanaka et al., and Dalal et al. Appealed claims 15 and 16 are directed

towards a composition comprising particulate TCP, further comprising a secondary additive that is a biological additive. The Examiner acknowledges that neither Kawamura et al. nor Tanaka et al. teach a secondary additive that is a biological additive, but asserts that Dalal et al. teaches a composition comprising TCP and a bioactive agent. However, Appellant respectfully submits that the teachings of Dalal et al. fail to cure the deficiencies of Kawamura et al. and Tanaka et al.

Appealed claims 15 and 16 each depend indirectly from claim 1 and accordingly recite a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, regardless of whether Dalal et al. teaches a secondary additive that is a biological additive, as the Examiner argues, one of ordinary skill in the art would not arrive at the invention recited in appealed claims 15 and 16 by merely combining the teachings of Kawamura et al., Tanaka et al., and Dalal et al.

Moreover, even if the combination of Kawamura et al. and Tanaka et al. taught the five aforementioned properties, which they do not, a person of ordinary skill in the art still would not arrive at the invention recited in appealed claims 15 and 16 by merely combining the teachings of Kawamura et al. and Tanaka et al. with Dalal et al. Dalal et al. is directed to a ß-TCP composition and the use thereof to prepare porous ß-TCP granules which can be combined with a binder to form a moldable putty composition. Nothing in Dalal et al. teaches or suggests adding a biological additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims. Additionally, nothing in Dalal et al. teaches or suggests adding a biological additive to a composition comprising particulate TCP while maintaining the ability to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Indeed, a person of ordinary skill in the art would expect the opposite—namely, that adding a biological additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims would alter the ability of the TCP to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al., Tanaka et al., and Dalal et al. fails to render appealed claims 15 and 16 obvious.

H. Claim 17

Appellant respectfully submits that appealed claim 17 is inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein. Appealed claim 17 depends indirectly from claim 1 and accordingly recites a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claim 17 is non-obvious over Kawamura et al. and Tanaka et al.

Appealed claim 17 further recites a composition comprising particulate TCP, further comprising a secondary additive wherein the secondary additive is a pharmaceutical additive. The Examiner asserts that Tanaka et al. teaches the addition of a pharmaceutical additive. However, Appellant respectfully submits that the teachings of Kawamura et al. and Tanaka et al. fail to render appealed claim 17 obvious.

Tanaka et al. is directed to a biomaterial comprising particulate calcium phosphate, such as a tricalcium phosphate, which is compounded with a copolymer of lactic acid, glycolic acid, and caprolactone. However, nothing in Tanaka et al. teaches or suggests adding a pharmaceutical additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims. Additionally, nothing in Tanaka et al. teaches or suggests adding a pharmaceutical additive to a composition comprising particulate TCP while maintaining the ability to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Indeed, a person of ordinary skill in the art would expect the opposite—namely, that adding a pharmaceutical additive to a composition comprising particulate TCP having the crystal size, particle size, and surface area recited by the appealed claims would alter the ability of the TCP to be densified to form an article having a minimum dimension of about 0.5 cm or greater that transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm. Thus, one of ordinary skill in the art would not have been motivated

to add a pharmaceutical additive to the claimed composition in view of the teachings of Tanaka et al.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claim 17 obvious.

I. Claim 69

Appellant respectfully submits that appealed claim 69 is inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein.

Appealed claim 69 is directed towards a composition comprising particulate TCP, wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article has a compressive strength of 150 MPa or greater. The Examiner acknowledges that both Kawamura et al. and Tanaka et al. are silent with regard to compressive strength. However, the Examiner asserts that the TCP of appealed claim 69 is structurally indistinguishable from the prior art, and thus, the prior art TCP would inherently possess the same properties. Appellant respectfully submits that the combination of Kawamura et al. and Tanaka et al. does not inherently possess the properties recited in appealed claim 69.

Appealed claim 69 depends indirectly from claim 1 and accordingly recites a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claim 69 is non-obvious over Kawamura et al. and Tanaka et al.

Additionally, because the prior art does not teach all of the five aforementioned properties recited in appealed claim 69, it is impossible for the composition set forth in appealed claim 69 to be structurally indistinguishable from the TCP set taught in the prior art. In order to establish the inherency of a claimed property in the prior art, the prior art must *necessarily* have that claimed property. *See, e.g., Mehl/Biophile Int'l Corp. v. Milgraum*, 192 F.3d 1362 (Fed. Cir. 1999) ("Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient."). There is no evidence presented in either Kawamura et al. or Tanaka et al.

which indicates that the recited compressive strength would be necessarily present if their teachings were to be combined. Indeed, the Examiner has relied on a conclusory assertion that such a result would be obtained, without providing any basis for such an assertion. Such conclusory assertions are insufficient to support a *prima facie* case of obviousness. *See, e.g., In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). Therefore, because the prior art does not teach all of the five aforementioned properties recited in appealed claim 69, it is impossible for the prior art to inherently have the compressive strength that is recited in appealed claim 69. Accordingly, appealed claim 69 is inventive over Kawamura et al. and Tanaka et al.

In fact, the disclosure of Tanaka et al. teaches against the assertion that the calcium phosphate particles have a compressive strength of 150 MPa or greater. Specifically, Tanaka et al. teaches that the calcium phosphate particles taught by Tanaka et al. must be compounded with a copolymer in order to achieve necessary strength. This is evidence that the calcium phosphate particles of Tanaka et al. are not capable of being consolidated to form a TCP article having a compressive strength of about 150 MPa or greater, as recited by appealed claim 69. Appellants have discovered that consolidated TCP articles having surprisingly high compressive strength can be formed from TCP compositions through careful control of the particle size, crystal size, and surface area of the precursor TCP composition. This is not taught or recognized by Tanaka et al. To the contrary, Tanaka et al. teaches away from the invention recited in appealed claim 69 by teaching that tricalcium phosphate material can only achieve desirably strength and rigidity when it is compounded with a copolymer as taught by Tanaka et al.

Accordingly, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claim 69 obvious.

J. Claim 79

Appellant respectfully submits that appealed claim 79 is inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein.

Appealed claim 79 recites that when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article has a density that is 90% of the theoretical density or greater. The Examiner acknowledges that both Kawamura et al. and Tanaka et al. are silent with regard to density. However, the Examiner asserts that the

TCP of appealed claim 79 is structurally indistinguishable from the prior art, and thus, the prior art TCP would inherently possess the same properties. Appellant respectfully submits that the combination of Kawamura et al. and Tanaka et al. does not inherently possess the properties recited in appealed claim 79.

Appealed claim 79 depends indirectly from claim 1 and accordingly recites a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claim 79 is non-obvious over Kawamura et al. and Tanaka et al.

Additionally, because the prior art does not teach all of the five aforementioned properties recited in appealed claim 79, it is impossible for the composition set forth in appealed claim 79 to be structurally indistinguishable from the TCP set taught in the prior art. In order to establish the inherency of a claimed property in the prior art, the prior art must *necessarily* have that claimed property. *See, e.g., Mehl/Biophile Int'l Corp. v. Milgraum*, 192 F.3d 1362 (Fed. Cir. 1999) ("Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient."). There is no evidence presented in either Kawamura et al. or Tanaka et al. which indicates that the recited density would be necessarily present if their teachings were to be combined. Indeed, the Examiner has relied on a conclusory assertion that such a result would be obtained, without providing any basis for such an assertion. Such conclusory assertions are insufficient to support a *prima facie* case of obviousness. *See, e.g., In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). Therefore, because the prior art does not teach all of the five aforementioned properties recited in appealed claim 79, it is impossible for the prior art to inherently have the compressive strength that is recited in appealed claim 79.

In particular, while Tanaka et al. teaches that the particulate calcium phosphate is preferably sintered before compounding with a copolymer purportedly "resulting in a high density" of the tricalcium phosphate, there is no indication that such densification could result in a densified article having a density that is 90% of the theoretical density or greater, as recited by appealed claim 79. Accordingly, appealed claim 79 is inventive over Kawamura et al. and Tanaka et al.

K. Claims 80-82

Appellant respectfully submits that appealed claims 80-82 are inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein.

Appealed claims 80-82 are directed towards a composition comprising particulate TCP, wherein the particulate TCP is produced using a wet chemical approach, and each depends, either directly or indirectly, from claim 1. Accordingly, each of claims 80-82 recites a composition comprising particulate TCP having properties (1)-(5) discussed above. Neither Kawamura et al. nor Tanaka et al, either taken alone or in combination, discloses properties (1)-(5), as discussed above. Thus, appealed claims 80-82 are non-obvious over Kawamura et al. and Tanaka et al.

Moreover, both Kawamura et al. and Tanaka et al. each fail to teach or suggest a particulate tricalcium phosphate composition produced using a *wet chemical* approach. Instead, Kawamura et al. is directed to a β-tricalcium phosphate prepared by a *mechanochemical* process involving preparing a slurry of hydrogen calcium phosphate and calcium carbonate powders in water and then subjecting that slurry to attrition (e.g., using a ball mill). *See* Abstract; col. 2, ll. 31-49; col. 3, ll. 29-43, and Example 1. Indeed, Kawamura et al. contrasts this mechanochemical approach from a wet chemical approach, which it describes as suffering numerous disadvantages including low purity and poor crystal formation. *See* col. 1, ll. 46, to col. 2, ll. 12.

Additionally, one of ordinary skill in the art would not arrive at a composition of the purity recited in the appealed claims, such that when the claimed particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm, by using the mechanochemical process set forth in Kawamura et al. As discussed above, Kawamura et al. uses an attrition milling process to obtain the calcium phosphate composition set forth therein. It is well-known in the art that attrition milling leads to impurities in the resulting milled composition. *See, e.g.,* F.F. Lange et al., "Effects of attrition milling and post-sintering heat treatment on fabrication, microstructure and properties of transformation toughened ZrO_2," *Journal of Materials Science*, 21:768-774 (1986) ("[I]mpurities introduced during attrition milling can be significant relative to the

unmilled powder."), submitted with the response to Office Action dated October 12, 2010; *see also* Declaration of Ahn at ¶ 6. These impurities would undoubtedly impact the ability of the densified TCP to transmit light. *See id.* at ¶ 5. Thus, one would not arrive at the invention set forth in appealed claims 80-82, with the claimed purity, by following the teachings of Kawamura et al. in combination with Tanaka et al.

L. Claims 83-85

Appellant respectfully submits that appealed claims 83-85 are inventive over Kawamura et al. and Tanaka et al. for at least the reasons set forth herein.

Appealed claim 83, and appealed claims 84-85 which depend therefrom, each recite a composition comprising particulate TCP:

(1) having an average particle size of 5 μm or less, an average crystal size of 250 nm or less, and a surface area of about 20 m^2/g or greater;
(2) produced using a wet chemical approach; and
(3) having a density that is 90% of the theoretical density or greater when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater.

First, and as discussed in Section 1.A above, neither Kawamura et al. nor Tanaka et al., taken individually, discloses the (1) particle size, (2) crystal size, and (3) surface area recited by the appealed claims, and one of ordinary skill in the art would not have been motivated to combine the surface area and crystal size of Kawamura et al. with the particle size of Tanaka et al. to arrive at the invention recited in the appealed claims. Accordingly, for at least the reasons set forth in Section 1.A. above, appealed claims 83-85 are non-obvious over Kawamura et al. and Tanaka et al.

Additionally, and as discussed in Section K above, both Kawamura et al. and Tanaka et al. each fail to teach or suggest a particulate tricalcium phosphate composition produced using a *wet chemical* approach. Moreover, and as discussed in Section J above, both Kawamura et al. and Tanaka et al. are silent with regard to density, and there is no evidence presented in either Kawamura et al. or Tanaka et al. which indicates that the recited density would be necessarily present if their teachings were to be combined.

Therefore, Appellant respectfully asserts that the combination of Kawamura et al. and Tanaka et al. fails to render appealed claims 83-85 obvious.

Conclusion

In view of all of the foregoing, Appellant respectfully submits that the present claims are inventive and that the rejection should be withdrawn.

Respectfully submitted,

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Claims Appendix

1. (Previously Presented) A composition comprising particulate tricalcium phosphate (TCP) having an average particle size of about 5 μm or less, an average crystal size of about 250 nm or less and a surface area of about 20 m^2/g or greater, wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article transmits about 50% or more light having a wavelength in the range of about 150 nm to about 1,000 nm.

2. (Original) The composition of claim 1, wherein the particulate TCP has an average particle size of about 1 μm or less.

3. (Original) The composition of claim 1, wherein the particulate TCP has an average crystal size of about 200 nm or less.

4. (Previously Presented) The composition of claim 1, wherein the particulate TCP comprises α-TCP.

5. (Original) The composition of claim 1, wherein the particulate tricalcium phosphate is densified.

6. (Original) The composition of claim 1, further comprising a secondary additive.

7. (Original) The composition of claim 6, wherein the secondary additive is present in an amount of between about 1% and about 50% by volume.

8. (Original) The composition of claim 6, wherein the secondary additive comprises a structural additive.

9. (Original) The composition of claim 8, wherein the structural additive comprises a metal oxide.

10. (Original) The composition of claim 9, wherein the metal oxide comprises zirconia.

11. (Original) The composition of claim 8, wherein the structural additive has an aspect ratio of about 2 or greater.

12. (Original) The composition of claim 6, wherein the secondary additive is an organic species.

13. (Original) The composition of claim 6, wherein the secondary additive is a polymeric additive.

14. (Original) The composition of claim 13, wherein the polymeric additive is selected from the group consisting of polylactic acid, polyglycolic acid, polylactic/polyglycolic acid copolymers, polypropylenefumarate, polyhydroxybutyric acid, polyhydroxyvaleric acid, polycaprolactone, polyhydroxycarboxylic acids, polybutyrene succinate, polybutylene adipate, collagen, chitosan, alginate, celluloses, starches, sugars, polypeptides, polyethylene glycols, vinyl pyrrolidones, acrylamides, methacrylates, copolymer micelles, and combinations thereof.

15. (Original) The composition of claim 6, wherein the secondary additive is a biological additive.

16. (Original) The composition of claim 15, wherein the biological additive is selected from the group consisting of plasmid DNA, RNA, proteins, bone morphogenetic proteins, and combinations thereof.

17. (Original) The composition of claim 6, wherein the secondary additive is a pharmaceutical additive.

18-68. (Cancelled)

69. (Previously Presented) The composition of claim 1, wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article has a compressive strength of 150 MPa or greater.

70. (Previously Presented) The composition of claim 1, wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article transmits about 70% or more light having a wavelength in the range of about 150 nm to about 1,000 nm.

71-77. (Cancelled)

78. (Previously Presented) The composition of claim 1, wherein the particulate TCP comprises β-TCP.

79. (Previously Presented) The composition of claim 1, wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article has a density that is 90% of the theoretical density or greater.

80. (Previously Presented) The composition of claim 1, wherein the particulate TCP is produced using a wet chemical approach.

81. (Previously Presented) The composition of claim 80, wherein the wet chemical approach comprises (i) precipitating a TCP precursor material from a solution containing a calcium salt and a phosphate source, (ii) recovering the TCP precursor material, (iii) milling the TCP precursor material to form a powder, and (iv) transforming the TCP precursor powder to form particulate TCP.

82. (Previously Presented) The composition of claim 81, wherein the TCP precursor powder is transformed to particulate TCP by calcination.

83. (Previously Presented) A composition comprising particulate tricalcium phosphate (TCP) having an average particle size of about 5 μm or less, an average crystal size of about 250 nm or less and a surface area of about 20 m^2/g or greater, wherein the particulate TCP is produced using a wet chemical approach, and wherein when the particulate TCP is densified to form an article having a minimum dimension of about 0.5 cm or greater the article has a density that is 90% of the theoretical density or greater.

84. (Previously Presented) The composition of claim 83, wherein the wet chemical approach comprises (i) precipitating a TCP precursor material from a solution containing a calcium salt and a phosphate source, (ii) recovering the TCP precursor material, (iii) milling the TCP precursor material to form a powder, and (iv) transforming the TCP precursor powder to form particulate TCP.

85. (Previously Presented) The composition of claim 83, wherein the TCP precursor powder is transformed to particulate TCP by calcination.

Evidence Appendix

None.

Related Proceedings Appendix

None.